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PARTIAL DOCUMENT

OPERATION CASTLE

126893

A VERY PRELIMINARY REPORT

ON THE

RESULTS OF THE [redacted] SHOT

DELETED VERSION ONLY

Submitted by

Task Group 7.1

[redacted]

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Carl Wilson 3/31/86


W. E. Ogle, CTG 7.1

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H. K. Gilbert, CTU-13




JF-8305

27 April 1954
(Date)





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## INTRODUCTION

The [redacted] shot was detonated on Eninman Island of [redacted] The device was designed by the UCRL at Livermore to test a [redacted] than that used in the previously tested devices.

At the time of firing the atmospheric conditions with respect to fall-out and sampling criteria were satisfactory, but heavy showers in the area caused serious difficulties from the point of view of test instrumentation. Records show that the light transmission conditions were such as to automatically prevent firing of the shot from about 4 A.M. until about ten minutes before shot time. At shot time the transmission from Eninman to Enyu was sufficient to allow firing, but scattering of the light by fog or rain was such as to prevent proper photography. Thus no photographs of the fireball were obtained from any station, and the early "hot spot" photography also failed even though the instrumentation operated properly. However, enough data were obtained by other means (Radiochemistry, progress of reaction studies, threshold detectors, shock arrival times) to obtain a fair picture of what went on.

The times of arrival and overpressures on Airukiraru, Airukiiji and Eniirikku indicate a total energy release of some

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[redacted] with the lower number being perhaps more plausible in the light of the hydrodynamic yield. Observation of the total number of 14 Mev neutrons by means of threshold detectors suggest [redacted]

The first check in determining the cause of the unexpectedly [redacted] is to ascertain the operation of the [redacted] The initial alpha

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# Project 2.6b - RADIOCHEMICAL ANALYSIS OF SURFACE CONTAMINATION

Project Officer - R. C. Tompkins -

## Objectives

The objectives of this work were to study the distribution of certain nuclides within fall-out particles and to determine some of the differences in radiochemical properties between liquid and solid fall-out.

## Instrumentation

Total fall-out collectors were set up on Enyu, Rukoji, Arriikan, and Bokororyuru Islands. On account of a failure in the timing circuit, the collector on Bokororyuru operated before the shot. The collector on Enyu did not operate properly. Collectors on Rukoji and Arriikan operated properly.

## Results

Since the yield DELETED [redacted] DELETED the samples recovered were too small to size-grade. Comparisons of the aqueous and solid phases were made, however, as shown in Table 2.6b-1. Additional data will be covered in later reports.

TABLE 2.6b-1
COMPARISON OF LIQUID VS SOLID FALL-OUT

| Location | $Mo^{99}$ Accqueous/Solid Ratio |
|---|---|
| Rukoji | 0.303 |
| Arriikan | 0.74 |





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[redacted]

A sample of coral sand was scooped up from the ground on Aomoen Island for leaching studies to determine distribution of activities within the fall-out particles. The sample was leached once with water and then with successive portions of dilute hydrochloric acid. Data are given in Table 2.6b-2. Weight of total sample was 2.1453 g.

TABLE 2.6b-2
ACTIVITY REMOVED FROM AOMOEN SAND BY LEACHING
CORRECTED TO K+12.2 DAYS

| Leach No. | Weight Dissolved (mg) | Specific Activity of Solution (c/min/mg) Gross F.P.'s | $Mo^{99}$ | $Zr^{95}$ | $Mo^{99}/Zr^{95}$ at Zero Time |
|---|---|---|---|---|---|
| 1 | 2.4 | $1.40 \times 10^4$ | $1.7 \times 10^3$ | $4.8 \times 10^2$ | 63 |
| 2 | 88.9 | $6.41 \times 10^3$ | $6.1 \times 10^1$ | $6.2 \times 10^1$ | 18 |
| 3 | 98.4 | $2.12 \times 10^3$ | $2.8 \times 10^1$ | $1.0 \times 10^1$ | 50 |
| 4 | 97.3 | $9.15 \times 10^2$ | 9.4 | 5.7 | 30 |
| 5 | 91.0 | $5.61 \times 10^2$ | Not Determined | | |
| 6 | 187.3 | $2.73 \times 10^2$ | Not Determined | | |
| 7 | 187.8 | $1.57 \times 10^2$ | $9.0 \times 10^{-2}$ | $5.1 \times 10^{-1}$ | 3.2 |
| 8 | 378.5 | $3.84 \times 10^2$ | $6.4 \times 10^{-1}$ | 2.0 | 6.0 |
| 9 | 179.0 | $4.07 \times 10^2$ | Undetectable | $4.8 \times 10^{-1}$ | Very Low |
| 10-14 | Data not yet available | | | | |

R-factor calibration data for this operation are not available at this time. However, some indication can be obtained from the fact that a $Mo^{99}/Zr^{95}$ ratio of about 23 is usually obtained in the home laboratory for a thermal bombardment of $U^{235}$.





[redacted]

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Conclusions

The data of Table 2.6b-2 appear to confirm the evidence from Operation Ivy that for the detonation of a thermonuclear device on a coral surface $Mo^{99}$ tends to concentrate on the surfaces of fall-out particles, while $Zr^{95}$ does not. Further work is in progress.



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Project 11.2 - CLOUD SAMPLING (H. Plank)

Because of gear trouble and accidental decompression the RB-36 sampling control aircraft was replaced by the back-up control B-36 with back-up control personnel. The back-up arrived in the shot area at approximately H+15 minutes with a clear view of the cloud lying above a solid cirrus layer, the top of which lay between 37 and 38 thousand feet. In addition to an opportunity to use the back-up control system, this shot also afforded the chance to try an emergency recovery of an F84G sample from the Bikini airstrip.

Although restricted from very high altitudes by the presence of the back-up control personnel, the secondary control B-36 (comprised by one of the high altitude B-36's) collected a sample at 45,000 feet after completing its control function. Blue Flight was prevented from collecting samples because of mechanical aircraft difficulties in one plane of each element. The number of fissions collected by each aircraft is shown in Table 11.2-1.

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Although the number of fissions collected is about a factor of ten less than in previous shots on Castle, fractionwise the present samples are similar. The high altitude B-36,





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Floyd 1, was in the topmost layers of the cloud at 55,000 feet absolute altitude and had to come down several thousand feet to conduct sampling. A private communication from Jere Knight indicates that the topmost section of the cloud had a calcium to fission ratio approximately 1% of that at lower altitudes.

A picture of the cloud taken from the control airplane soon after shot time is shown in Fig. 11.2-1 lying above the cirrus cover. In the original print dark portions suggest that a considerable portion of the cloud lay below the cirrus in the natural weather existing up to 37 - 38 thousand feet. Figs. 11.2-2 and 11.2-3 show the cloud at later times after burst when the wind shear effects can be seen from upwind and cross-wind views respectively. The long streamer seen in Fig. 11.2-3 is the result of a wind velocity at 55,000 feet (absolute) which is approximately 17 knots slower than at the cirrus level and is an illustration that negative as well as positive velocity shear can produce the same relative effects. A dimensional analysis of this photograph shows that the length of the streamer is commensurate with this velocity shear. A notable characteristic of this cloud was that the radiation intensities observed were a factor of from five to nine lower than for previous clouds at the same altitudes and times after burst.





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## TABLE 11.2-1
## SAMPLING RESULTS FOR [redacted] SHOT

| Aircraft Code | Type Aircraft and Number | Avg. Sampling Time (Hrs. after Burst) |
|---|---|---|
| Red 1 | F-84G 030 | 2:40 |
| Red 2 | F-84G 037 | 2:30 |
| Red 3 | F-84G 033 | 2:30 |
| Red 4 | F-84G 051 | 2:55 |
| White 1 | F-84G 046 | 3:40 |
| White 2 | F-84G 053 | 3:40 |
| White 3 | F-84G 038 | 3:55 |
| White 4 | F-84G 049 | 3:50 |
| Blue 1 | Abort | |
| Blue 2 | Abort | |
| Blue 3 | Abort | |
| Blue 4 | Abort | |
| Floyd 1 | FB-36 1086 | 4:35 |
| Floyd 2 | FB-36 1083 | 5:15 |
| Wilson 1 | WB-29 7269 | 3:10 |

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PART III

TASK UNIT 7





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TASK UNIT 7 - J. D. Servis, Maj. USA

RADIOLOGICAL SAFETY

(J. D. Servis)

A partial Rad-Safe survey was conducted on [redacted] day with incomplete atoll results. Results of this survey did indicate that Bokobyaadaa, Namu, Enirikku, Bikini, and the Yurochi - Aomoen chain were materially contaminated. Reentry and recovery were accomplished to a large degree on shot day. No secondary fall-out was detected as having resulted from this shot.

Lagoon contamination was restricted to a V shape pattern with apex at Eninman and tips covering the Bokobyaadaa - Aomoen area. A reading of 100 mr/hr was obtained over the Eninman anchorage at H+4 hours. Enyu anchorage was clear of contamination while Bikini anchorage showed traces of contamination at H+4 hours.

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TABLE TU-7-1

[redacted] SUMMARY (r/hr)

| Island | H + 4 hrs Extrapolated | D + 1 day | D + 7 days | Pre-shot Background |
|---|---|---|---|---|
| Enyu | .03 | .03 | .03 | .03 |
| Bikini | 5.0 | .67 | .07 | .10 |
| Aomoen | 20.0 | 2.5 | 1.6 | .35 |
| Romurikku | 10.0 | 1.6 | .80 | .50 |
| Uorikku | 5.0 | 1.0 | .60 | .47 |
| Yurochi | 5.2 | 1.0 | .60 | .45 |
| Namu | 250. | 30.0 | 16.0 | 1.5 |
| Bokobyaadaa | 600. | | 16.0 | 9.0 |
| Ourukaen | .60 | .08 | .02 | .012 |
| Arriikan | .50 | .07 | .01 | .008 |
| Eniirikku | 210.0 | 2.4 T | 1.8 | .008 |
| Eninman | | | .02 | .010 |
| Airukiiji | .02 | .02 | .02 | .018 |
| Crater | 5000. | 50.* | 60. | |

T - Reading at 100 feet

* - Reading at 200 feet

Underlined islands indicate islands contaminated by [redacted] shot.





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Task Unit 15 - TIMING AND FIRING (H. Grier)

(H. Grier)

World Time

The world time as measured by the world time clock on [redacted] 1954. This figure is not corrected for transit time from the signal generators in Hawaii to the receiver at Station 70.

Timing System

The operation of the timing system including radio signals was normal.





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TABLE A-1
WEATHER (BIKINI ATOLL) AT 0620M, 7 APRIL 1954

Surface Pressure 1009.7 mb
Surface Temperature 81°F
Surface Humidity 82%

| Altitude (ft) | Wind Direction (degrees) | Velocity (knots) | Pressure (mb) | Temp. (°C) | Dew Pt. (°C) | Relative Humidity |
|---|---|---|---|---|---|---|
| Surface | 040 | 20 | 1009.7 | 81 | 75 | 79 |
| 1000 | 070 | 17 | 973 | 23.5 | 22.0 | |
| 1500 | | | 958 | 22.4 | 21.2 | |
| 2000 | 060 | 16 | 940 | 21.1 | 20.4 | 82 |
| 3000 | 090 | 08 | 909 | 19.7 | 19.0 | |
| 4000 | 120 | 07 | 878 | 18.4 | 17.5 | 80 |
| 5000 | 150 | 08 | 848 | 17.1 | 16.2 | |
| 6000 | 170 | 12 | 819 | 15.8 | 14.9 | 78 |
| 7000 | 170 | 17 | 789 | 14.3 | 13.5 | |
| 8000 | 190 | 14 | 760 | 12.7 | 12.2 | |
| 9000 | 200 | 14 | 733 | 11.2 | 10.9 | |
| 10,000 | 210 | 14 | 705 | 9.6 | 9.5 | 75 |
| 12,000 | 180 | 17 | 655 | 6.5 | 5.6 | |
| 14,000 | 200 | 08 | 608 | 3.0 | -0.9 | 69 |
| 16,000 | 190 | 10 | 563 | -0.3 | -10.4 | 67 |
| 18,000 | 200 | 10 | 522 | -3.8 | -12.9 | 64 |
| 20,000 | 220 | 04 | 483 | -7.8 | -23.6 | 24 |
| 25,000 | 190 | 20 | 396 | -18.0 | -29.6 | 24 |
| 30,000 | 210 | 22 | 322 | -27.5 | -32.9 | 42 |
| 35,000 | 210 | 28 | 258 | -39.3 | | |
| 40,000 | 230 | 34 | 206 | -51.8 | | |
| 45,000 | 280 | 24 | 161 | -63.8 | | |
| 50,000 | 240 | 35 | | | | |
| [illegible] | 230 | 39 | | | | |





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